

SUPPORT FOR THE AMENDMENTS

Support for the amendment of Claim 1 is found on page 4, lines 5-7, in the specification.

Claims 4 and 5 are amended to delete the terms “a mixture of metallic and” and “a mixture of multi-walled and,” respectively.

Claim 8 is cancelled.

Claim 9 is amended to be consistent with Claim 1.

Claims 27 and 28 are new and are supported beginning on the last line of page 3 and bridging to the second line of page 4.

Claim 29 is new and is supported on page 7, lines 20-21, in the specification.

No new matter is believed added to this application by entry of this amendment.

Upon entry of this amendment, Claims 1-6, 9-13 and 15-29 are active. Claims 15, 19, 25 and 26 are withdrawn.

REMARKS/ARGUMENTS

The claimed invention provides a photovoltaic device, comprising a composition of carbon nanotubes and of at least one organic hole conductor, wherein the band gap of said carbon nanotubes lies in the range of from about 0.5 to about 1 eV, and **a band gap of the at least one organic hole conductor is in a range of from 1.75 to 2.25 eV.**

Applicants have described that according to the invention, by adjusting the respective band gaps of the carbon nanotubes to a range of about 0.5 to about 1 eV and of the organic hole conductor to around 2 eV, an effective absorption of light either through the organic hole acceptor/conductor or through the carbon nanotubes, is ensured, independent of the source of irradiation, which may have a solar spectrum or the spectrum of an indoor light source, which is typically shifted to longer wavelengths, as follows (page 10, last paragraph):

Without wishing to be bound to any particular mechanism of action, the inventors presently believe that the mechanism underlying the invention works as follows: light can excite an electron either in the organic hole acceptor/conductor, which, in many cases is likely to be a conjugated polymer, or it can excite an electron in the carbon nanotubes (see also fig. 2). In the first case, the photo-excited electron is transferred to the conduction band of the carbon nanotubes, which in this case act as electron acceptors and conductors, while the photo-generated hole stays in the valence band of the organic hole acceptor/conductor. The effectively separated charge-carriers are transported to the electrodes, if present, leading to a photovoltaic activity. If the light excites an electron in the carbon nanotubes, the photo-excited hole is transferred to the organic hole acceptor/conductor with the same result. By adjusting the respective band gaps of the carbon nanotubes, which typically lie in the range of 0.5 to about 1 eV, and of the organic hole acceptor/conductor, e. g. a conjugated polymer, which typically lies around 2 eV, an effective absorption of light, either through the organic hole acceptor/conductor or through the carbon nanotubes, is ensured, independent of the source of irradiation, which may have a solar spectrum or the spectrum of an indoor light source, which is typically shifted to longer wavelengths.

No such photovoltaic device is disclosed or suggested by the references cited in the Office Action of March 10, 2011.

Applicants respectfully note that Claim 1 is herein amended to recite that the at least one organic hole conductor has a **band gap of in a range of from 1.75 to 2.25 eV**.

The rejection of Claims 1-4, 6, 8-10, 13, 16-18 and 21-24 under 35 U.S.C. 102(b) or in the alternative under 35 U.S.C. 103(a) over Kymakis et al. (Applied Physics Letters, American Institute of Physics. New York, Us vol. 80, no. 1,7, pages 112-114) with support of Dukovic et al. (Structural Dependence of Excitonic Optical Transitions and Band-Gap Energies in Carbon Nanotubes, Nano Letters, Vol. 5, No. 11 (pp 2314-2318) 2005) is respectfully traversed.

Kymakis describes a photovoltaic device containing poly(3-octylthiophene) having a band gap of 2.4 eV and single walled carbon nanotubes. Kymakis does not disclose or suggest a device having a composition of carbon nanotubes and at least one organic hole conductor, which are adjusted to the specific ranges as according to Claim 1.

Dukovic describes an investigation of the structural dependence of band gap energies in carbon nanotubes and nowhere discloses or suggests a photovoltaic device according to Claim 1.

Applicants respectfully call the Examiner's attention to *In re Arkley*, 455 F.2d 586, 587, 172 USPQ 524, 526 (CCPA 1972) which states:

“[R]ejections under 35 U.S.C. 102 are proper only when the claimed subject matter is identically disclosed or described in “the prior art.” Thus for the instant rejection under 35 U.S.C. [102(b)] to have been proper, the . . . reference must clearly and unequivocally disclose the claimed [subject matter] or direct those skilled in the art to the [subject matter] . . .”

Applicants submit that as described above, Kymakis neither explicitly nor inherently discloses the presently claimed subject matter and therefore, cannot meet the Arkley test for anticipation.

Furthermore, Applicants note that in a discussion of “**Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in View of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.***” the Office has stated:

The rationale to support a conclusion that the claim would have been obvious is that **all the claimed elements were known in the prior art** and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art at the time of the invention. “[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” **If any of these findings cannot be made, then this rationale cannot be used to support a conclusion that the claim would have been obvious to one of ordinary skill in the art, . . .** (Federal Register, Vol. 72, No. 195, page 57529) (Bold added) (Citations omitted)

Again, as described above neither Kymakis nor the combination of Kymakis and Dukovic make all the elements of the presently claimed invention known and according to the KSR guidelines provided above, a conclusion of obviousness cannot be supported.

Applicants additionally and specifically point to dependent Claim 13 and note that Kymakis does not disclose or suggest carbon nanotubes which are vertical with respect to one of the electrodes. The reference simply describes a composite of carbon nanotubes and poly(3-octylthiophene) which is deposited onto a coated glass substrate (page 112, right column, line 14 bridging to page 113). Applicants submit that Kymakis is silent with respect to alignment of the nanotubes. In contrast, according to the present invention nanotubes which are vertical to one of the electrodes are achieved by vertically growing the nanotubes on one of the electrodes (page 5, last full paragraph).

Additionally, Applicants note that Claims 27-29 recite the elements of specific embodiments of the present invention which are neither disclosed nor suggested by Kymakis nor the combination of Kymakis and Dukovic.

Accordingly, Applicants respectfully request that the rejection of Claims 1-4, 6, 8-10, 13, 16-18 and 21-24 under 35 U.S.C. 102(b) or in the alternative under 35 U.S.C. 103(a) over Kymakis with support of Dukovic be withdrawn.

The rejection of Claim 5 under 35 U.S.C. 103(a) over Kymakis with support of Dukovic and further in view of Tsukamoto et al. (JP 2003-096313) is respectfully traversed.

Claim 5 directly depends from Claim 1 and includes all the description of the independent claim. The deficiencies of the primary reference combination relative to anticipating and/or rendering obvious the invention described in Claim 1 and claims dependent thereon is described above. Tsukamoto neither discloses nor suggests a device according to the claimed invention as presently claimed. Therefore, Applicants submit that the cited combination of references does not make all the elements of the invention known and a conclusion of obviousness cannot be supported.

Accordingly, withdrawal of the rejection of Claim 5 under 35 U.S.C. 103(a) over Kymakis with support of Dukovic and further in view of Tsukamoto is respectfully requested.

The rejection of Claims 11 and 12 under 35 U.S.C. 103(a) over Kymakis with support of Dukovic and further in view of Forrest et al. (U.S. 6,451,415) is respectfully traversed.

The deficiencies of each of the cited primary reference combination has been described above. Forrest describes photodetector organic photosensitive optoelectronic devices having multilayer structures and an exciton blocking layer. This reference is cited to show a multilayer structure. However, Forrest does not disclose or suggest multilayers according to the presently claimed invention, and therefore, Forrest does not cure the basic deficiencies of the primary reference combination. Withdrawal of the rejection of Claims 11 and 12 under 35 U.S.C. 103(a) over Kymakis with support of Dukovic and further in view of Forrest is respectfully requested.

The rejection of Claim 20 under 35 U.S.C. 103(a) over Kymakis with support of Dukovic and further in view of Ganzorig et al. (Alkali metal acetates as effective electron injection layers for organic electroluminescent device,” Materials Science and Engineering B, Elsevier Sequoia, Lausanne, Ch, vol. 85 no. 2-3, 22 August 2001 (2001-08-22), pages 140-143) is respectfully traversed.

Claim 20 depends from Claims 1 and 2 and includes all the elements of both claims.

Ganzorig is cited to show a coating layer of alkali metal acetate of fluoride on an electrode. This reference describes a coating applied at the interface of an aluminum/tris(8-hydroxyquinoline)aluminum electrode/transfer layer. Nowhere does Ganzorig disclose or suggest a composite of carbon nanotubes and of at least one organic hole conductor, each having the specific band gaps recited in Claim 1.

Application No. 10/567,929
Reply to Office Action of March 10, 2011

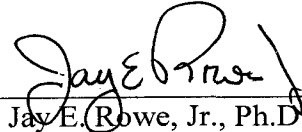
In view of the above, Applicants respectfully submit that the combination of Ganzorig and Kymakis with support of Dukovic does not make all the elements of the invention known, and therefore, the cited combination of references cannot render the claimed invention obvious. Accordingly, withdrawal of the rejection of Claim 20 under 35 U.S.C. 103(a) over Kymakis with support of Dukovic and further in view of Ganzorig is respectfully requested.

The rejection of Claims 4 and 5 under 35 U.S.C. 112, second paragraph, is believed obviated by amendment. Description of mixtures are deleted from both claims. Accordingly, withdrawal of the rejection is respectfully requested.

Applicants respectfully submit that the above-identified application is now in condition for allowance and early notice of such action is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Jay E. Rowe, Jr., Ph.D.
Registration No. 58,948

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/07)